

**METHODS FOR FABRICATING HIGH-PRECISION THERMALLY
STABLE ELECTROMAGNETIC COILS**

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Abstract of the Disclosure

Methods are disclosed for manufacturing coils for use in a charged-particle-beam (CPB) optical system such as would be used in a CPB imaging apparatus or CPB lithography apparatus. In an embodiment, on a surface of a coil substrate is formed a mask layer defining channels corresponding to a coil pattern. Using the 10 mask layer as a mask, a pattern of conductive coil-forming material is applied to the substrate surface in the channels. Coil elements formed on the substrate surface by this method exhibit steep sides and a desired aspect ratio. To such end, the depth of the channels desirably is greater than the desired thickness of the coil elements. Alternatively, a metal layer (for use as an electroplating electrode) is formed on a 15 surface of the substrate. The metal layer is coated with a resist at a thickness of at least 0.1 mm. The resist is removed by lithography from regions where coil elements are to be formed. In the regions, conductive metal is grown by electroplating to form the coil elements.

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